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First record of Gauguin's blunt-nose lizardfish, *Trachinocephalus gauguini* Polanco, Acero & Betancur 2016 (Teleostei: Synodontidae) outside the Marquesas Archipelago

SHIH-YU WANG[1], JHEN-NIEN CHEN[1], BARRY C. RUSSELL[2] & WEI-JEN CHEN[1,3]

[1]*Institute of Oceanography, National Taiwan University, No. 1, Sec. 4, Roosevelt Road, Taipei 10617, Taiwan*
[2]*Museum & Art Gallery of the Northern Territory, GPO Box 4646, Darwin, NT 0801, Australia*
[3]*Corresponding author. E-mail: wjchen.actinops@gmail.com*

Abstract

Trachinocephalus gauguini Polanco, Acero & Betancur, 2016 was described based on eighteen specimens collected from off the Marquesas Islands, the only location where this species has been recorded until now. Through morphological and molecular examination of *Trachinocephalus* specimens collected from an exploratory cruise conducted in June 2014 under the *Tropical Deep-Sea Benthos* program along the northern coast of the New Ireland Province, Papua New Guinea, we demonstrate the presence of this species in Papua New Guinea waters. This new record suggests a wide distribution for this rarely collected species in the western Pacific Ocean.

Key words: New record, Tropical Deep-Sea Benthos, Papua New Guinea, Synodontidae, Molecular Taxonomy

Introduction

Trachinocephalus Gill 1861 is a genus of lizardfishes belonging to the aulopiform family Synodontidae, a group of small predatory fishes that inhabit inshore and offshore bottom areas at depths down to about 365 meters, but more commonly found in mid-shelf areas at depths between 25 and 90 meters (Russell 2002).

The main characteristics of the genus differentiating *Trachinocephalus* from other lizardfish genera are its blunt head, with relatively short snout, and high number of anal-fin rays (Anderson *et al.* 1966; Russell 2002). The genus was previously regarded as monotypic, containing only a single species, *Trachinocephalus myops* (Forster 1801), with nearly circum-tropical and subtropical distribution (Briggs 1960). However, a recent taxonomic revision (Polanco *et al.* 2016) based on morphological and molecular evidence, challenged this traditional classification and recognized three valid species, including a newly described species, *T. gauguini* Polanco, Acero & Betancur 2016, found exclusively in French Polynesian waters around the Marquesas Islands in the western Pacific. The other two congeneric species, *T. myops* and *T. trachinus* (Temminck & Schlegel 1846), recognized by Polanco *et al.* (2016) have much wider distribution ranges in the Atlantic and the Indo-West Pacific Oceans (except the Marquesas), respectively. The three species are currently known to be allopatrically distributed (Polanco *et al.* 2016).

Recently, we examined lizardfish specimens (55 in total) collected during three exploratory cruises (campaigns: PAPUA NIUGINI, MADEEP, and KAVIENG 2014) conducted between 2012 and 2014 under the *Tropical Deep-Sea Benthos* (TDSB) program by the R/V ALIS deployed by the French Oceanographic Fleet in the waters off northern and northeastern Papua New Guinea. Three *Trachinocephalus* specimens were collected from the KAVIENG 2014 cruise. Among them, two are identified as *T. gauguini* and the other as *T. trachinus*).

The purpose of the present work is to record both species from New Ireland Province, Papua New Guinea. Molecular data for the mitochondrial *COI* gene from the three collected specimens were obtained and compared to the available *COI* sequence of the paratype specimen of *T. gauguini* (voucher: USNM 409222) deposited in NCBI GenBank (accession no.: KP099622).

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Materials and methods

Morphological measurements, meristic features and compared specimens. Methods for obtaining morphological data from the three *Trachinocephalus* specimens followed Anderson *et al.* (1966). Abbreviations used throughout the text included HL (head length) and SL (standard length); for others see Table 1. All measurements were taken in a straight line, made with a dial caliper and recorded to the nearest 0.1 mm. For each specimen, 21 measurements and five counts were recorded, following Polanco *et al.* (2016). The examined specimens were deposited at the ichthyological collection of the National Taiwan University Museums, Taipei (NTUM) under registration nos: NTUM 11201 (tissue voucher PNG 3126), NTUM 11085 (tissue voucher PNG 3127), and NTUM 11212 (tissue voucher PNG 3163).

Molecular data. Whole genomic DNA was extracted from the tissue samples of the three *Trachinocephalus* specimens using an automatic extractor: LabTurbo 48 Compact System and LGD 480–500 kits (Taigene Biosciences Corp.) following the manufacturer's protocol. A fragment of the mitochondrial protein-coding gene cytochrome oxidase subunit I (*COI*) was amplified and sequenced for this study. Protocols for collecting molecular data followed those outlined in Ward *et al.* (2005) and in a previous study in Lo *et al*. (2015). The *COI* amplicons were sequenced by Sanger sequencing technique at the Genomics BioSci &Tech (Taipei) and at the Center of Biotechnology (National Taiwan University). The chromatograms were edited and assembled using CodonCode Aligner (version 7.1.2). The sequences were further aligned to each other and with the homologous sequence from *T. gauguini* published by Polanco *et al.* (2016) (accession no. KP099622). The software PAUP* (Swofford 2002) was used to compute pairwise *p*-distances to assess the genetic similarity among the samples from the same species and the inter-specific genetic diversity of the *COI* sequences of the included species. The *COI* sequences obtained in this study were deposited in GenBank (accession nos. MG751097-MG751099).

Results and discussion

Morphometric and meristic data of the specimens are summarized in Table 1 and Table 2. The result of the genetic comparison of *COI* sequences between the examined specimens and the homologous sequence retrieved from GenBank are shown in the Table 3.

Trachinocephalus gauguini Polanco, Acero & Betancur, 2016, new record

Figure 1A–B; Table 1–2

Material examined. NTUM 11085 (tissue voucher: PNG 3127) and NTUM 11212 (tissue voucher: PNG 3163). Both specimens were collected from mid-shelf areas around 20 km west of Kavieng, New Ireland Province, Papua New Guinea (Fig. 2) on September 2, 2014 by R/V ALIS from station CP4455, 2° 23.4' S, 150° 37' E, 60–72m, and station CP4456, 2°35' S, 150°40' E, 134–144m, respectively (campaign: KAVIENG 2014).

Diagnosis. Morphometric data and meristic data for the two Papua New Guinea specimens are as in Table 1 and 2 respectively. The morphological characteristics fit within the range of the identification key, description of body color pattern, and photographs provided in Polanco *et al.* (2016): L_{Sn} 6.7–10.0% of HL, L_{Sn} 12.6–18.9% of D_B, L_{Sn} 31.6–51.7% of D_E, W_I 4.0–6.7% of HL; pectoral fin rays 11, anal fin rays 14–16; pectoral, caudal and anal fin yellow; dorsal fin dark yellow; four obvious yellow stripes along the body longitudinally, with several inconspicuous vertical bars across; an oval black spot above the dorsal border of the operculum, and a rather wide dark blotch below the eye (indistinct in NTUM 11212) (Fig. 1A, B). A blunter snout and broader dark blotch beneath the eye distinguish *Trachinocephalus gauguini* from other species of *Trachinocephalus*.

Trachinocephalus trachinus (Temminck & Schlegel 1846)

Figure 1C; Table 1–2

Material examined. NTUM 11201 (tissue voucher: PNG 3126), specimen collected from the same site as *T. gauguini,* NTUM 11085 (see above).

TABLE 1. Morphometric data of *Trachinocephalus* specimens examined in this study. Data from Polanco *et al.* (2016) is included for comparison. Standard lengths (SL) and head lengths (HL) are given in mm. The other measurements are given as ratios (actual lengths or lengths in holotype are shown in the parentheses). Head measurements are expressed as percentage of HL; body measurements are expressed in percentage of SL. Asterisk indicates the number did not fit in the range of the ratio provided by Polanco *et al.* (2016).

	T. trachinus		*T. gauguini*		
	NTUM 11201	Polanco *et al.* (2016) n=66	NTUM 11085	NTUM 11212	Polanco *et al.* (2016) *n*=17 (Holotype)
Standard length (SL)	40.6	65.3–228	51.3	76.2	40.4–135 (124.5)
Body depth (D_B)	17.48 (7.1)	10.4–20.7	18.09 (9.1)	18.77 (14.3)	16.9–22.9 (25.7)
Body width (W_B)	12.06 (4.9)	9.9–16.9	14.51 (7.3)	13.52 (10.3)	12.4–17.6 (21.9)
Head length (HL)	30.3 (12.3)	25.2–31.8	29.04 (14.9)	31.23 (23.8)	29.4–32.5 (40.4)
Snout length (L_{Sn})	11.38 (1.4)	8.9–14.7	8.05 (1.2)	8.82 (2.1)	6.7–10.0 (3.3)
Eye diameter (D_E)	22.36 (2.75)	11.0–22.6	21.48 (3.2)	17.65 (4.2)	14.7–22.5 (6.5)
Interorbital width (W_I)	6.50 (0.8)	5.2–12	6.71 (1.3)	6.30 (1.5)	4.0–6.7 (2.3)
Premaxillary length (L_p)	51.22 (6.3)	50.3–61.2	55.03 (8.2)	53.78 (12.8)	50.2–56.3 (21.8)
Distance from snout to the origin of pelvic fin (Sn-OP_v)	33.62 (13.65)	28.4–35.9	33.92 (17.4)	31.76 (24.2)	31.8–36.4 (41.0)
Distance from snout to the origin of dorsal fin (Sn-OD)	42.61 (17.3)	37.4–43.5	40.94 (21.0)	41.34 (3.15)	36.4–43.1 (53.7)
Distance from snout to the origin of anal fin (Sn-OA)	67.49 (27.4)	61.4–70.2	67.45 (34.6)	63.25 (48.2)	60.5–67.7 (79.5)
Distance from origin of dorsal fin to the origin of adipose fin (OD-OA)	33.74* (13.7)	40.3–46.4	44.14 (22.2)	38.06 (29.0)	38.1–46.1 (54.5)
Length of the longest dorsal ray (L_{DR})	17.4 (7.1)	15.8–26.2	19.10 (9.8)	19.69 (15.0)	16.5–21.1 (23.6)
Length of the longest pectoral ray (L_{PcR})	10.71 (4.35)	10.2–14.0	12.77 (6.55)	11.94 (9.0)	11.6–13.7 (17.0)
Length of the longest pelvic ray (L_{PvR})	26.97 (10.95)	22.2–29.3	25.63 (13.15)	25.07 (19.1)	24.1–29.4 (34.6)
Length of the last dorsal ray (L_{LDR})	10.09 (4.1)	8.7–11.8	11.13 (5.6)	12.86 (9.8)	9.5–12.9 (14.7)
Dorsal-fin base (DB)	15.76 (6.4)	15.0–18.7	15.31 (7.7)	16.08 (12.25)	14.9–17.5 (19.6)
Anal-fin base (AB)	22.41 (9.1)	20.6–26.8	23.46 (11.8)	23.29 (17.75)	22.3–30.5 (30.7)

TABLE 2. Meristic data of three *Trachinocephalus* specimens examined in this study. Data from Polanco *et al.* (2016) is included for comparison.

	T. trachinus		*T. gauguini*		
	NTUM 11201	Polanco *et al.* (2016) n=75	NTUM 11085	NTUM 11212	Polanco *et al.* (2016) n=18
Lateral-line scales	57	53–58	56	59	56–59
Dorsal-fin rays	12	11–14	11	11	11–13
Anal-fin rays	13	13–18	14	15	14–16
Pectoral-fin rays	12	11–13	11	11	11–12
Predorsal scales	17	14–18	18	17	16–18

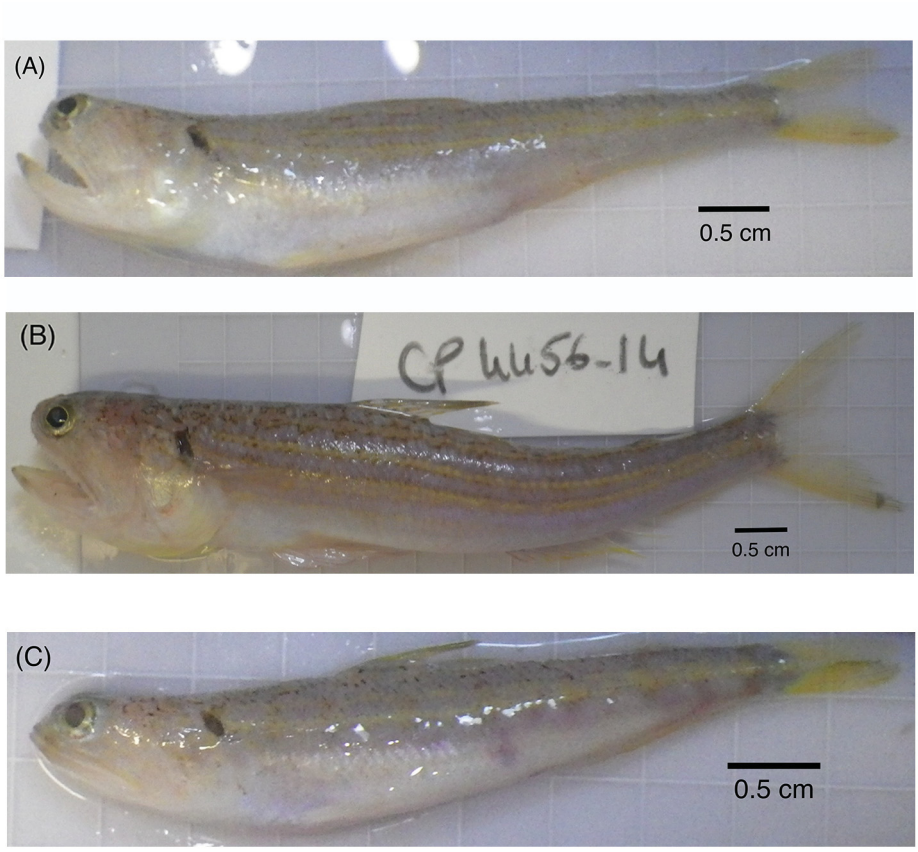

FIGURE 1. Three *Trachinocephalus* specimens collected from Papua New Guinean waters. (A) *T. gauguini*, NTUM 11085, SL = 51.3 mm (B) *T. gauguini*, NTUM 11212, SL = 76.4 mm (C) *T. trachinus*, NTUM 11201, SL = 40.6 mm. (Photographed by J.-N. Chen).

Diagnosis. Morphometric and meristic data for the Papua New Guinea specimen is in Table 1 and 2 respectively. According to the diagnosis provided in Polanco et al. (2016), this species can be distinguished from other two *Trachinocephalus* species by the following meristic characteristics: L_{Sn} 50.89% of D_E; L_{Sn} 19.71% of D_B; W_I 6.5% of HL; D_E 22.36% of HL; length of the last dorsal ray 10.09% of L_S; anal rays 13; pectoral rays 12; predorsal scales 17. This specimen is a transitional juvenile with black peritoneum spots still faintly visible. The pectoral, caudal and anal fin yellow, while dorsal fin dark yellow. Several yellow stripes along the trunk longitudinally, with the most obvious one across the middle part of the body. An oval black spot above the dorsal border of the operculum. Indistinct dark spot below the eye. The morphological data of the Papua New Guinea specimen matches the description of *T. trachinus* (Table 1, 2; Fig. 1C).

The genetic pairwise distance analysis based on *COI* sequences shows high interspecific variation between *T. gauguini* and *T. trachinus* (*p*-distance: 0.13944–0.14053) while low intraspecific variation within *T. gauguini* specimens (*p*-distance: 0-0.00157) (Table 3). This result supports the morphological diagnosis of the three specimens and confirms their species status.

Remarks. In a checklist of the marine and estuarine fishes of the Madang District, Papua New Guinea (Fricke *et al.* 2014), recorded eight synodontid species. One of these was identified as *Trachinocephalus "myops"* based on material deposited in the Australian Museum (AMS) and Western Australian Museum (WAM). It should be noted that *T. myops* is a species complex and following Polanco *et al.* (2016) we apply the name *T. trachinus* for *T. "myops"* populations from the Indo-West Pacific. Our study additionally records *T. trachinus* from New Ireland, and extends the distribution of *T. gauguini* from its previously reported area (Marquesas Archipelago) to the western Pacific (Papua New Guinea). Our work shows that *Trachinocephalus trachinus* and *T. gauguini* occur sympatrically in Papua New Guinea waters, and as both were collected from the station CP4455, we can confirm that these two species share the same habitat.

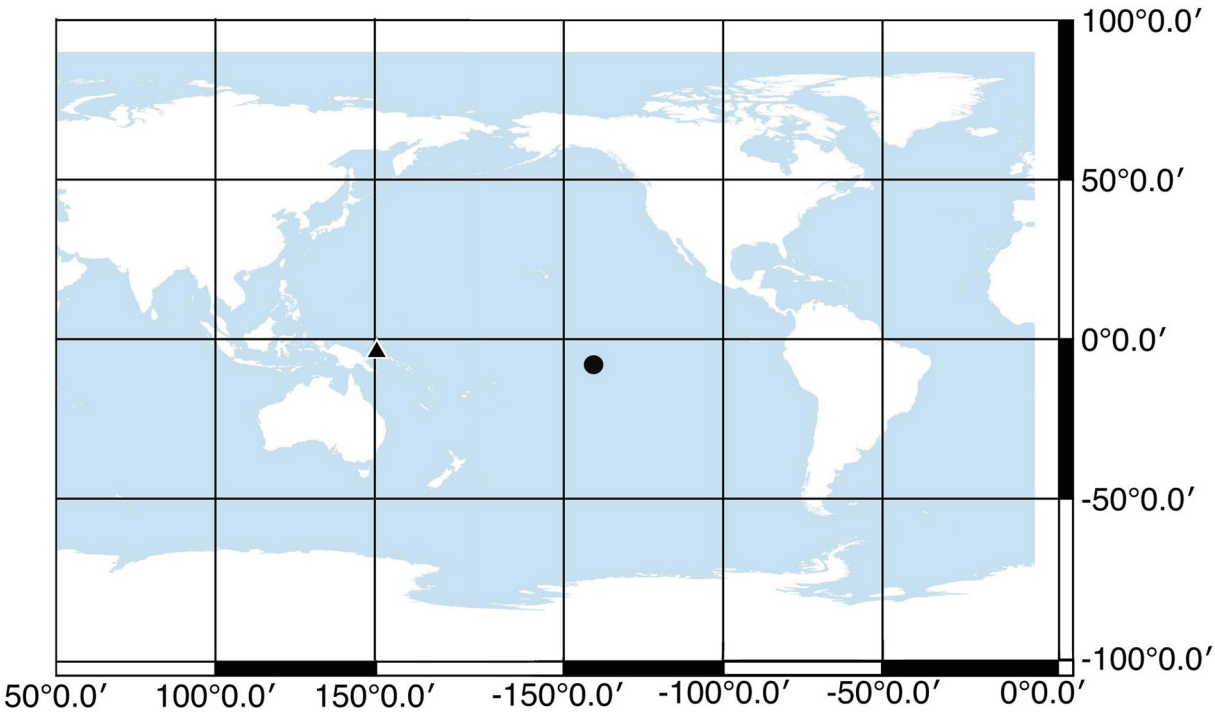

FIGURE 2. Distribution records of *Trachinocephalus gauguini*. Circle, occurrence described in Polanco *et al.* (2016); triangle, new record from Papua New Guinea (this study).

TABLE 3. Matrix of pairwise genetic distances (*p*-distance) of *COI* sequences.

Sample				Sample			
No.	Species	Tissue no.	GenBank access. no.	1	2	3	4
1	*T. trachinus*	PNG3126	MG751097	-			
2	*T. gauguini*	PNG3127	MG751098	0.14053	-		
3	*T. gauguini*	PNG3163	MG751099	0.13944	0.00155	-	
4	*T. gauguini*	MARQ-221	KP099622	0.13996	0.00157	0.00000	-

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